

CHEMICALS

Project Fact Sheet



HIGH THROUGHPUT CATALYST SCREENING

BENEFITS

- Increased process efficiency
- Decreased need for downstream separations
- Increased yield and decreased amount of undesired by-products
- Reduced greenhouse gas emissions
- Lowered energy requirements

APPLICATIONS

This new high-throughput testing apparatus can be applied wherever catalysts are developed or evaluated, in both the chemical and petroleum industries. Ethylene production is just one example where discovery of new catalysts could have a substantial impact on energy consumption and greenhouse gas emissions.

NEW APPARATUS WILL ACCELERATE DISCOVERY OF CATALYSTS

Heterogeneous catalysts are used in nearly every area of chemical production. Traditional methods of catalyst production are costly and time consuming, and often lead to only a few successful catalysts per year. The value of the products that are made in the U.S. using catalysts exceeds \$1 trillion annually. A catalyst that is not operating at peak efficiency, or is wrong for the job, can waste billions of dollars each year; therefore it is important to the chemical industry that the catalysts are as efficient and selective as possible. A combinatorial testing apparatus capable of quickly evaluating an array of catalysts under realistic industrial conditions has the potential to yield significant energy savings and reduced carbon dioxide emissions.

The bottleneck in productivity in the high-throughput discovery of new catalysts lies in the inability of traditional catalyst testing methods to test catalysts fast enough. There is not an apparatus available today that can thoroughly test catalysts for performance as quickly as they are made. The proposed instrument will be an affordable entry point for large and small companies to acquire high throughput catalyst testing capability. Providing such a tool to researchers throughout the chemical industry will rapidly accelerate the discovery of new heterogeneous catalysts. An example of an initial application for the apparatus would be to screen for new catalysts for the production of ethylene, which is currently manufactured using a very energy-intensive process. In applying this technology to the ethylene production process, total energy savings of 689 trillion BTU could be achieved by the year 2020.

HIGH THROUGHPUT APPARATUS



High throughput screening apparatus rapidly tests activity and selectivity of heterogeneous catalysts.



Project Description

Goal: To design, build and evaluate an apparatus capable of testing an array of heterogeneous catalyst samples in parallel.

The proposed instrument will be capable of testing an array of heterogeneous catalysts under realistic conditions of elevated temperature and pressure and with a well-defined space velocity. The apparatus will consist of three primary components: (1) a high-pressure manifold capable of uniformly supplying feedstock to a matrix of catalysts, (2) a reactor capable of sustaining reactions for a matrix of individual catalyst samples, and (3) an analytical method that provides data on the activity and selective of each catalyst rapidly and independently. Data will be collected rapidly, with a full snapshot of catalyst performance being collected every 15 seconds. The detection method will allow speciation of the reactants and products of the reaction and a measurement of the concentration of each of these species.

Progress & Milestones

The scientists at TDA have developed high-throughput catalyst testing equipment that has been used successfully on in-house research projects for the past three years. Work is now progressing on the design and construction of the feed manifold and catalytic reactor.

Future research will focus on:

- Integrating the high-throughput reactor and detection system
- Conducting preliminary and beta testing of the integrated high-throughput testing apparatus

Commercialization

The target customers for the resultant high-throughput materials testing apparatus will be chemical operating companies, catalyst companies, and to a lesser extent, national laboratories and universities. Another potential customer is the chemical manufacturer who receives catalysts from different vendors and must evaluate them for optimal activity over time.



PROJECT PARTNERS

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